

EVALUATION OF WALKERS FOR ELDERLY PEOPLE

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Abstract- The aim of this study was to evaluate three types of walkers for elderly people. Four elderly patients participated in the study. The experiments were performed using three walkers: a familiar conventional folding walker, a caster walker and a power-assisted walker. We evaluated walking speed, body acceleration and an electromyogram of the gastrocnemius during use of each walker. The results indicated that walkers should be selected according to the patient's walking ability. Comparison between Power-assisted walker and parallel bar, the walking speed in power-assisted walker is higher than that in parallel bar. Power-assisted walkers are suitable for patients who are used to using a wheelchair.

Keywords - walker, elderly, walking speed, acceleration, electromyogram

I. INTRODUCTION

Walking is a basic everyday activity. In an aging society, elderly people need to walk to promote their health and independence. By retaining ambulatory independence, elderly people increase their quality of life and reduce the costs of both public health services and private health insurance. Mobility is one of the most important factors in maintaining physical and mental health.

To assist walking, several conventional types of walker are available. Different types are used for different walking abilities (see Fig. 1). The folding walker and the four-wheel walker with seat and basket are used under supervision. The folding walker consists of a folding four-legged frame with a supporting grip that the user can grasp or lean on. Wheelchairs are commonly used for elderly people who either cannot walk or can walk only with assistance and supervision. Caster walkers are used in hospitals and nursing homes. Users of caster walkers can lean on the supporting arms, and a non-weight-bearing gait is possible. However, these walkers can also be used by elderly people who have fairly good motor function.

One of the authors has recently developed a power-assisted walker for elderly people who have difficulty walking. The device consists of four wheels and a supporting pad that is held by the user. The amount of assistance provided by this walker is based on the amount of force applied. The walker moves forward, or turns, at a speed proportional to the propulsive force applied by the user. The dynamic characteristics can be easily adjusted by changing the control parameters.

Application or adaptation of these walkers is the important issue. In rehabilitation training, several walking stages are observed, and the use of a suitable walker is

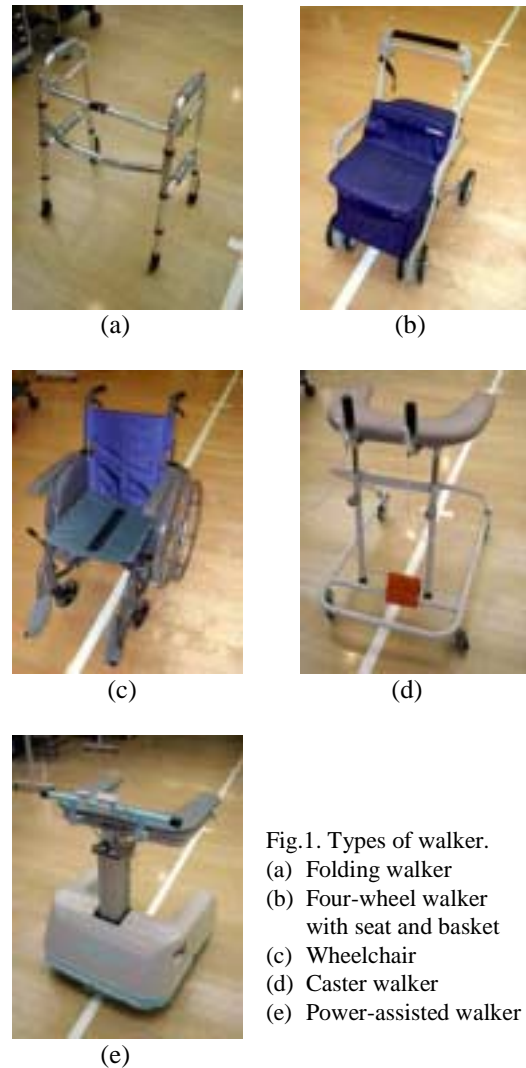


Fig.1. Types of walker.
(a) Folding walker
(b) Four-wheel walker with seat and basket
(c) Wheelchair
(d) Caster walker
(e) Power-assisted walker

required to provide an improvement in the user's quality of life. However, no physiological evaluation based on walking ability has been made of the suitability of each kind of walker for each walking stage. The aim of this study was to evaluate the physiological parameters for walkers.

II. METHODOLOGY

Six elderly people aged between 70 and 91 years (average 82 ± 7.9 years) participated in the study. Before the experiment, written informed consent was obtained from each subject or the subject's family.

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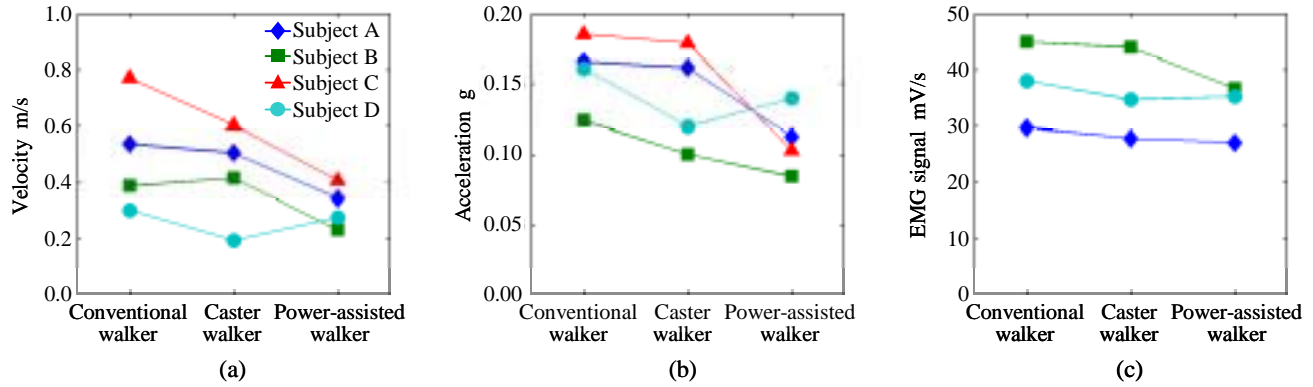


Fig. 2. Walking speed (a), acceleration (b), and electromyogram (c), for conventional walker, caster walker and power-assisted walker.

The walkers that we evaluated were conventional walkers that the subjects used every day, a caster walker (KA381, Minato, Japan) and a power-assisted walker (Hitachi, Japan).

Of the conventional walkers, one subject used a folding walker (Safety Arm, SAW-C, East Eye, Japan), two used four-wheel walkers with seat and basket (Silver car healthbag U one-two 198, Zojirushi Baby Ltd, Japan) and one used a wheelchair (MN-150, Meiko, Japan).

The four subjects who could walk with supervision walked along a 10-meter straight course marked by a tape that was attached to the floor. Two position sensors were located at positions two and eight meters along the tape. The effective course was thus six meters in each direction, a total of 12 meters. The experiment was performed under the supervision of an occupational therapist out of consideration for the subjects' safety. Two out of six subject who could not walk without assistance waked in parallel bar with the same set-up. To measure body acceleration, a tri-axial accelerometer was attached to the subject's back, close to the center of gravity, and to obtain a surface electromyogram, an electrode was attached to the gastrocnemius. The walking speed was calculated from the time taken to traverse the distance between the two position sensors. These data were converted to digital signals and stored on the hard disk of a personal computer. An electromyogram could not be obtained for one subject because of an injury to the lower extremity. The recorded walking speeds, root mean square (rms) of accelerations, and integrated electromyograms were then analyzed.

III. RESULTS

Fig. 2 shows the speed, acceleration and integrated electromyogram for the conventional walker, the caster walker and the power-assisted walker. For four subjects who could walk with supervision. The speed of the experimental power-assisted walker was 0.4 meters per second, the slowest of the three types tested. Both the acceleration and the speed gradually decreased at a closely related rate Impact

acceleration is increased at high speed. The integrated electromyograms show gradual decreases as the speed decreases.

The comparison between walked with power-assisted walker and waked in parallel bar shows higher speed , large vertical acceleration and small lateral and antero-posterior accelerations in power-assisted walker.

IV. DISCUSSION

Three types of walker were compared with respect to speed, acceleration, and surface electromyogram. The speed is proportional to the rms acceleration. The speed obtained using the conventional walker was the fastest of the three types tested. The subjects of this study could walk with supervision and so have relatively good motor function. In such cases, power-assisted walkers or caster walkers are not suitable. Power-assisted walkers can be used by subjects who need assistance to walk. We observed that the two subjects who could walk with assistance and usually used a wheelchair, could walk using the power-assisted walker.

Further studies are required to develop the criteria concerning the suitability of walkers for elderly people.

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